Food & Nutrition

Research Briefs

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Nutrition and Health

Americans may be consuming substantially more calories than surveys show, according to findings from 12 long-term studies. The 266 volunteers—from 21 to 64 years old—reported consuming an average 18 percent fewer calories on food intake records prior to the studies than they actually needed to maintain weight during the studies. There was no difference in reporting based on the volunteers' gender, age or weight. Eighty-one percent underreported their food intake, 8 percent overreported and 11 percent were accurate to within 100 calories. If substantiated in larger studies, the findings have far reaching implications: The vast majority of food and nutrient intake data comes from individuals recalling or recording what they ate. These data are used by federal agencies to judge the nutritional status of the U.S. population and identify low intakes of vitamins or minerals. A higher food intake could mean that the "problem nutrients"—such as vitamin B6, zinc, magnesium and iron for women—are not such a problem. It could also explain why average body weight of the U.S. population increased between the late 1960's and late 1970's while reported food intake went down.

Beltsville Human Nutrition Research Center
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An amino acid is emerging as another risk factor for heart disease. Findings from a large-scale study corroborate earlier reports that an elevated blood level of the amino acid homocysteine is an independent risk factor—not related to cholesterol or fat levels. Homocysteine is the precursor of two amino acids that are used by the body to synthesize proteins. Researchers examined homocysteine levels in 170 men with premature (under age 60) coronary artery disease and a control group of 255. Twenty-eight percent of the men with clogged arteries had elevated levels versus 10 percent in the control group. And about half of the patients with clogged arteries—or 14 percent—were linked to a genetic abnormality. The other half may have been due to a deficiency in the B vitamins and folate, since high homocysteine can often be corrected with these supplements. The National Heart, Lung and Blood Institute partially funded the study.

Human Nutrition Research Center on Aging at Tufts
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Loading up on carbohydrates not only improves stamina during sustained, strenuous exercise such as long-distance running and cycling, it also cuts body losses of two important trace elements. Urinary losses of chromium and zinc are known to increase under stressful exercise. But when eight men doubled their carbohydrate intake 3 days before sustained exercise, their losses of chromium and zinc dropped an average 23 and 28 percent, respectively. Losses of potassium, magnesium and calcium were not altered. During the test, the men cycled ergometers submerged in 77 degree F water in 20-minute increments for a total of 160 minutes. Consuming the extra carbohydrates also helped them increase the amount of work they completed with less stress to the body, indicated by lower blood levels of the stress-hormone cortisol.

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A study of 211 women offers new evidence that taking estrogen after menopause improves a woman's blood cholesterol profile, possibly reducing risk of heart disease. The women had undergone natural menopause or had earlier had their ovaries surgically removed. Estrogen users

in the natural menopause group had a significantly higher ratio of the "good" HDL (high density lipoprotein) cholesterol to the "bad" LDL (low-density lipoprotein). That's important because HDL removes cholesterol from arteries and is critical in reducing risk. Estrogen users in this group also had significantly lower total cholesterol, LDL and fat-rich VLDL (very low density lipoprotein) particles than the non-users. Although HDL levels were not significantly higher with estrogen, the protein associated with HDL—probably a better measure of this particle—was. On the other hand, women who had had their ovaries surgically removed had significantly higher levels of HDL and its protein with estrogen, but the differences in total cholesterol, LDL and VLDL cholesterol were not significant. The study was funded in part by the National Heart, Lung and Blood Institute.

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Polyunsaturated fats—such as those in vegetable oils—did not surpress the immune system in people as it had in earlier studies with mice and rats. Those earlier results raised concerns because nutrition guidelines from the American Heart Association and other groups urge that polyunsaturates make up one-third of total fat in diets. The new findings from an 80-day study of eight volunteers, however, suggest that the immune system is not suppressed when a balanced, low-fat diet includes a level of polyunsaturates high enough to give cardiovascular benefits. In fact, the volunteers' regimen actually bolstered their immune systems. Total fat intake was held to 25 percent of each day's calories. Immune response improved whether polyunsaturates were low (3.5 percent of the day's total calories) or moderately high (13 percent) in the daily plan of balanced meals. To measure immune response, researchers monitored activity of disease-fighting white blood cells collected from blood samples. Further experiments are planned to confirm the findings.

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Evidence that smoking can accelerate bone loss comes from a 2-year study of 312 women past menopause. Researchers measured the women's bone density at four sites—the forearm, hip, spine and heel—at the beginning, middle and end of the study. All 312 women, who were between the ages of 40 and 70, began the study with about the same bone density. But the 34 smokers lost significantly more bone in the forearm—averaging nearly 1 percent per year compared with no loss for the 278 non-smokers. Bone loss in the hip and spine was also higher in the smokers but did not reach statistical significance. Smokers also retained less calcium from a supplement, suggesting that they absorbed less of the mineral to begin with. This could account for their higher bone loss. The negative effect of smoking on bone density is probably less than the loss of estrogen, a low calcium intake or the lack of physical activity, which could explain why earlier studies have yielded mixed findings. This study is the first to show that smoking can increase bone loss—at least in some bones—in older women.

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Copper-deficient diets that are high in sugar may turn certain iron compounds stored in rats' livers into a toxic substance that can't be used. And this could have implications for people. The finding, from a series of studies, explains why young rats routinely developed severe anemia, organ damage and died prematurely from copper-deficient diets only when the main source of carbohydrate was sugar—specifically fructose sugar. When it was starch, there were no ill effects. Injecting these animals with red blood cells cleared up the anemia and prevented organ damage, indicating the animals could not use the iron they had stored in their livers. An assay of their livers showed much more of this iron was in the form of tissue-damaging free radicals than the animals fed starch instead of fructose. Finally, giving fructose-fed animals a drug to remove iron from their bodies prevented most of the damage, indicating their iron was indeed toxic. Whether this occurs in people has not been studied. But Americans typically consume less than the minimum suggested intake of copper, and our fructose intake is increasing. Also, high alcohol consumption may have the same effect as fructose because we metabolize the two substances similarly. Research shows the danger lies in eating too much refined fructose from table sugar—which is half fructose—and from high-fructose corn sweeteners, not in eating fruit and other fructose-containing plant foods.

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We now better understand how dietary saturated fat and cholesterol increase the undesirable LDL cholesterol circulating in the blood. It hinges on the number and mobility of LDL receptors. The receptor—a sort of tug boat—attaches to LDL cholesterol at the surface of liver cells, ushers the fat globule inside to be broken down and returns for another globule. Researchers fed Cebus monkeys diets in which 30 percent of the calories were either corn oil or the more saturated coconut oil. Each diet was fed with and without cholesterol. Both saturated fat and cholesterol had two effects on the receptors: They reduced receptor numbers by suppressing the gene that initiates their production and they slowed receptor move-

ment through the cell membrane by reducing membrane fluidity. Diets high in saturated fat lead to less fluid membranes than unsaturated fat. Consequently, the receptor makes fewer round trips and removes less LDL cholesterol from the blood. Saturated fat alone depressed LDL receptors more than cholesterol alone, and the combined effects were additive.
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Tomorrow's Foods

Choosing the right color of mulch will increase plant growth. Southern peas, for example, perform better with mulch that's red. When pea plants were grown using red mulch, the yield was 3.0 tons per acre. That's compared to 2.8 tons per acre with white and 2.7 tons per acre with conventional black. Two color components of light influenced the plant growth: The percentage of blue in the light and the ratio of far-red to red. Red mulch had the highest far-red to red ratio but a lower blue component. In previous experiments, researchers found tomatoes had the highest yield when grown using red mulch.
Coastal Plains Research Center, Florence, SC
Patrick Hunt, (803) 669-5203

Brown rice could become a common staple instead of a specialty item. A process being patented by ARS extends the shelf life of properly packaged brown rice. Usually brown rice turns rancid after being stored about 6 months. That's changed by the new process, which doesn't alter the appearance or texture of the cooked product, nor does it remove valuable nutrients as heat treatments often do. Unlike white rice, brown rice is rich in dietary fiber, minerals and vitamins—particularly the B vitamins—because the bran, or outer brown layer, is not milled away. The bran oil is easily degraded by lipase enzymes into free fatty acids, leading to off-odors and off-flavors. ARS scientists found that treating brown rice with ethanol deactivates lipase enzymes in the bran, halting free fatty acid formation.
Southern Regional Research Center, New Orleans, LA
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A new mini garbanzo with a nutty, peppery flavor might become a tasty alternative to larger, milder-flavored garbanzos, common in salad bars. Also known as chick-peas, garbanzos are dietary staples in India and other countries on the Indian subcontinent. The new variety was named Sarah because a similar-sounding Turkish word, pronounced sari, means yellow, the color of the internal part of the chickpea seed. The new Sarah variety tolerates a serious fungal disease, known as chickpea blight, that has devastated garbanzo plantings in the Pacific Northwest in previous years. Besides serving the small, specialty domestic market that now relies on imports, Sarah may find a niche in the export market as well. To meet U.S. consumer preferences, researchers are now trying to breed a larger, blight-resistant bean.
Grain Legume Genetics and Physiology Research
Pullman, WA
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A new sweet potato variety is white at maturity instead of the traditional orange and tastes much like a white Irish potato. The new variety is called Sumor—Old English for summer—because the variety has the typical sweet potato's liking for heat. Sumor could make an ideal substitute crop for climates where it is too hot to grow Irish potatoes. While Sumors have only a fraction of the vitamin A found in regular sweet potatoes, they have more vitamin C than do most tomatoes, which qualifies it as a high-nutrition crop. Sumor sweet potatoes are commercially available from Foundation Seed Inc. at Clemson University.
U.S. Vegetable Lab, Charleston, SC
Philip Dukes, (803) 556-0840

Oriental persimmons are being recommended as a potential alternative crop in the Southeast. Known to be high in fiber and vitamins A and C, new research shows the fruit to have about three times as much vitamin C as citrus. It can provide 363 percent of the recommended daily intake of vitamin C. Usually grown in temperate to subtropical climates, the Oriental persimmon is now being grown as far north as central Georgia. Almost disease-and-insect free, it requires no more, maybe even less, care than other crops. Oriental persimmons are not to be confused with the smaller, seedier, American type that grows wild in the South and is so puckery.
Southeastern Fruit and Tree Nut Research Lab
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Food Freshness and Safety

Orange juice from a glass or plastic bottle, carton or tin can may soon taste like it was just squeezed from fresh-picked fruit. That's because ARS chemists have defined the mix of 20 flavor components in fresh orange juice and the balance of these compounds in commercially processed juices. Because heat during pasteurization affects these flavor compounds, it has been almost impossible for processors to keep the delicate flavor of fresh-squeezed juice. Now these compounds can be separated from orange juice concentrate, then added back during a later processing step—restoring the original mix of flavors. One processor is currently testing the method.

Citrus and Subtropical Products Research Lab
Winter Haven, FL
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A 4-foot-tall, factory-reject broomstick promises boll weevils food and sex, but lures cotton's nastiest enemy to a surprise death. Weevils can either chew the "bait stick's" insecticide-laced cap, or land on the coated stick, and die shortly after. In tests in Mississippi and Texas cotton fields, scientists used 100 times less insecticide—only 1 gram per acre—to control the weevils. Normally several spray applications of organophosphate insecticide are needed to try to control them. So far, in the second year of tests in Mississippi, scientists found up to 70 percent fewer boll weevils. The bait stick costs only about $1 to manufacture and it could be a viable alternative to control a pest that costs more than $300 million annually in crop losses and chemical control. Both the weevil-killing cap and coating on the stick are patented. ARS has signed research and development agreements with two companies to improve the stick for commercial use. The bait stick idea possibly could be used for other insect pests on other crops in the future.

Boll Weevil Research Lab, Starkville, MS
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New, high-tech probes could pinpoint residues of certain drugs in meat and poultry more quickly than current tests. Called monoclonal antibodies, the experimental probes might someday speed federal safety testing of meat and poultry. The antibodies seek and bind to residues of veterinary drugs called benzimidazoles. Farmers and ranchers rely on these drugs to protect cattle, sheep, pigs, chickens and goats from parasitic worms that damage the animals' lungs, liver or gastrointestinal tract. ARS scientists already have prepared probes to detect four benzimidazoles, and aim to produce antibodies to four additional ones this year. Federal food safety chemists check thousands of meat and poultry samples each year for benzimidazole residues.

Western Regional Research Center, Albany, CA
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Virtually all of the *Salmonella* cells in processed poultry are destroyed when irradiated at the federally-approved level. ARS scientists found that 99.99 percent are killed at the maximum dose set last year by the U.S. Food and Drug Administration (3.0 kiloGray); 99.5 percent of the bacteria die at the minimum dose recommended for poultry by USDA's Food Safety and Inspection Service (1.5 kiloGray). Tests also showed irradiation at or below the maximum level causes no losses of the B vitamins riboflavin and niacin and only a 3 to 9 percent loss of thiamin. However, chicken contributes less than 1 percent of the thiamin in U.S. diets. Although irradiation is not currently being used by the U.S. poultry industry, it could add an extra safeguard against food poisoning in addition to proper food processing techniques, refrigeration, good household handling and proper cooking.

Eastern Regional Research Center, Philadelphia, PA
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Freshly peeled carrots can be free of the white film that might otherwise mask their bright orange color. An ARS researcher says food processors can dip the peeled, ready-to-eat vegetables in a heated bath of water and citric acid for 30 seconds and then quickly dunk them into cold water. Refrigerated carrots will keep their attractive color up to 10 times longer if given the dip as soon as they've left the abrasion peeler—a processing device that rubs off carrots' skin. The technique won't affect taste; it's simple, fast, inexpensive and leaves carrots additive-free. Enzymes such as phenylalanine ammonia lyase likely cause the whitening. The heated citric acid stops the enzymes from forming. Citric acid is approved for food use. One U.S. food processor is already experimenting with the technique.

Western Regional Research Center, Albany, CA
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A simple, experimental automatic bagger for apples minimizes the chances of bruising the fruit when it's packed for grocers' shelves. Bruise damage is a primary cause of quality and grade loss of fresh market apples. But the new equipment decreases bruises 15-fold by allowing the apples to settle, instead of dropping, into a bag. USDA Extra Fancy grade allows no more than one bruise, 1/2 inch in diameter, per apple. Operated under commercial conditions at a packinghouse, the experimental equipment bagged all apples at nearly the U.S. Extra Fancy grade.

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The **Briefs** is published quarterly by ARS Information. For further information or addition to the mailing list, contact Judy McBride, nutrition editor, at (301) 344-4095; or write me at Bldg. 419, BARC-East, Beltsville, MD 20705.

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